REMARKS

The present application was filed on March 4, 1999 with claims 1-32. Claims 1, 15, 22 and 28 are the independent claims. In the outstanding Office Action dated March 20, 2002, the Examiner rejected claims 11, 13, 14 and 25 under 35 U.S.C. §112, second paragraph, and rejected each of claims 1-32 as being either anticipated under 35 U.S.C. §102(b) or unpatentable under 35 U.S.C. §103(a). The primary reference in each of the art rejections is U.S. Patent No. 5,710,650 (hereinafter "Dugan").

In this response, Applicants amend the specification to correct a minor typographical error, amend dependent claims 11, 13, 14, 20 and 25, and traverse the §102(b) and §103(a) rejections. Applicants respectfully request reconsideration of the present application in view of the above amendments and the following remarks.

The Examiner has rejected dependent claim 25 under §112, second paragraph, on the ground that "it is not clear how a demultiplexer can generate two or more distinct driver signals, nor is it clear how the demultiplexer is able to combine the respective optical signals and couple them into a transmission medium" (Office Action, section 2). Applicants have amended claim 25 to change "optical demultiplexer" in line 8 of the claim to --optical multiplexer--. The electronic demultiplexer is part of the apportioning system referred to in claim 22, and the optical multiplexer corresponds to the output element referred to in claim 22. The operation of the electronic demultiplexer and the optical multiplexer is clearly described in the specification. For example, the specification at page 4, lines 9-23, describes with reference to FIG. 2 the operation of an electronic demultiplexer 70 and an optical multiplexer 95, in a manner consistent with the limitations of amended claim 25. Applicants therefore submit that claim 25 as amended is fully compliant with §112, second paragraph.

The Examiner has rejected claims 11, 13 and 14 under §112, second paragraph, on the ground that there is insufficient antecedent basis for certain limitations thereof. Applicants have amended claims 11, 13 and 14 such that these claims as amended depend from claims 10, 12 and 12, respectively. It is believed that this amendment addresses the antecedent basis issues raised by the Examiner.

Independent claims 1, 15 and 28 stand rejected under §102(b) as being anticipated by Dugan. Applicants respectfully traverse this rejection.

With regard to claim 1, this claim is directed to a method for transmitting data content provided in a data signal. It includes the steps of assigning distinct portions of the data signal to two or more respective channels, and, for each channel, using corresponding assigned portions of the data signal to modulate an optical carrier at a respective wavelength associated with that channel. In addition, the claim specifies that the data content is carried, in a transmitted optical output signal, by energy at two or more of the respective wavelengths.

It is important to note that the claim calls for transmission of the data content provided in a single data signal by assigning distinct portions of that data signal to different channels, such that the data content is carried by energy at two or more channel wavelengths. An example of the claimed assignment of distinct signal portions of a data signal to different channels is shown in FIG. 7 of the drawings. In this example, an initial data stream 215 is separated into four distinct portions, each of which is assigned to a corresponding one of four wavelengths λ_1, λ_2, λ_3 and λ_4. It is important to note that each of the distinct portions corresponds to a different part of a single data signal as claimed, and not separate and independent data signals. An important advantage provided by this approach is enhanced security, as is described in the specification, at page 2, lines 6-10:

> As a consequence, successful reception of the original message requires both the ability to receive over the full set of wavelength channels used for transmission, and knowledge of the pattern of channel allocations, so that the portions can be reconstituted in the proper order. Security is enhanced because neither of these requirements is easily satisfied in an unauthorized interception of the transmitted signal.

Applicants respectfully submit that the present invention as set forth in independent claim 1 is not anticipated by Dugan. Dugan discloses a type of conventional dense wavelength division multiplexing (WDM) of multiple separate and independent data signals. Applicants have described such conventional arrangements in the Background portion of their specification, for example, at page 1, lines 5-14. In the optical transmitter 10 shown in FIG. 1 of Dugan, four 2.5 Gb/s data streams, each generated by multiplexing 32 separate and independent 78 Mb/sec data signals, are modulated onto a single fiber 48 via modulators 42 and WDM multiplexer 46. As indicated above, this is a type of conventional dense WDM. There is no separation of a given one of the data signals

into different portions, with different portions being assigned to different wavelength channels as claimed. Instead, it is clear from Dugan that the data signals that are combined in optical transmitter 10 are separate and independent data signals. For example, Dugan in column 5, lines 38-44, describes the operation of optical transmitter 10 of FIG. 1 in the following manner, with emphasis supplied:

> In essence, therefore, optical transmitter portion 10 includes overhead multiplexer module 12 and optical transmitter module 14 that includes four independent 2.5 Gb/s optical transmitters that are multiplexed together into one standard single-mode fiber prior to reaching the output connector.

Each "32-line grouping" referred to in column 5, lines 11-23, of Dugan includes 32 separate and independent 78 Mb/s data signals, with the combination of the 32 different 78 Mb/s data signals yielding a corresponding one of the 2.5 Gb/s data streams.

Other portions of the Dugan reference make it clear that the teachings therein relate to combination of multiple independent data signals, rather than assignment of different portions of a single data signal to different wavelength channels as claimed. For example, Dugan states as follows in column 7, lines 14-43, with emphasis supplied, regarding an embodiment which combines one hundred ninety-two 51 Mb/s data signals into a 10 Gb/s data stream:

> Even though the throughput data rate of the system is 10 Gb/s, the majority of signal processing is done at a data rate of 51 Mb/s, with subsequent multiplexing to bring all of the data into one signal line at 10 Gb/s. Processing the signals in parallel at 51 Mb/s saves a considerable amount of size, power, and cost of the electronic circuitry. After a significant amount of the signal processing is done, the one hundred ninety-two 51 Mb/s signals are divided into four groups, with each group containing 2.5 Gb/s worth of data, for processing into the final 10 Gb/s data stream.

The Dugan reference thus teaches to combine multiple separate and independent data signals into one or more higher-rate bit streams. As such, it fails to anticipate the present invention as set forth in independent claim 1.

Applicants similarly traverse the rejection of independent claims 15 and 28 under §102(b) as being anticipated by Dugan. For example, claim 15 is directed to a method of optical communication in which different portions of a received optical signal are assembled, from distinct wavelength channels, into a single, sequential data stream. In the optical receiver 50 of Dugan FIG. 2, this claimed method does not occur. Instead, Dugan separates a 10 Gb/s received optical signal into multiple and independent data signals. Similarly, claim 28 calls for an optical communication system in which a received input optical signal that contains data content in two or more distinct wavelength channels is separated into portions based on wavelength, with the portions being assembled into a single, sequential data stream. This claimed arrangement is simply not present in the Dugan reference.

Applicants therefore respectfully submit that the §102(b) rejection of independent claims 1, 15 and 28 is improper, and should be withdrawn.

Dependent claims 2-14, 16-21 and 29-32 are believed allowable for at least the reasons identified above with regard to their corresponding independent claims.

Independent claim 22 stands rejected under §103(a) as being unpatentable over Dugan in view of U.S. Patent No. 6,256,124 (hereinafter "Hait"). The Examiner acknowledges that Dugan fails to teach at least the "time windows" limitations of claim 22,and argues that Hait supplies these missing teachings. However, Applicants note that the above-described deficiencies of the Dugan reference also render the §103(a) rejection of claim 22 improper. More particularly, for reasons similar to those given above in conjunction with independent claims 1, 15 and 28, Dugan fails to teach the claimed apportioning of data content of a data signal into two or more distinct wavelength channels, and the output optical signal containing portions of the data content in two or more wavelength channels. Instead, the optical transmitter 10 in Dugan FIG. 1 simply combines multiple and independent data signals into a higher-rate optical signal via conventional dense WDM techniques. The Hait reference fails to remedy this fundamental deficiency of the Dugan reference, and as a result the proposed combination of Dugan and Hait fails to meet the limitations of claim 22. The §103(a) rejection of claim 22 is therefore believed to be improper and should be withdrawn.

Dependent claims 23-27 are believed allowable for at least the reasons identified above with regard to independent claim 22.

Attached hereto is a marked-up version of the changes made to the specification and claims by the present Amendment.

In view of the above, Applicants believe that claims 1-32 as amended are in condition for allowance, and respectfully request the withdrawal of the §112, §102(b) and §103(a) rejections.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

The paragraph of the Abstract beginning on page 17, line 2, has been amended as follows:

A method of optical communication having improved security is described. The data content of an initially provided data signal is apportioned among two or more distinct optical wavelength channels. A transmitted signal spans these two or more channels. A respective portion of the data content of the transmitted signal is allocated to each of the optical wavelength [channel] <u>channels</u>. In certain embodiments of the invention, each such portion comprises data placed in the pertinent wavelength channel during assigned time windows.

IN THE CLAIMS

11. (Amended) The method of claim [6] <u>10</u>, wherein:

a) the assigning step comprises assigning, to each [each] channel, those portions of the data signal that coincide with a recurring time window allocated to that channel;

b) the optical radiation at each of the coding wavelengths is provided in the form of a train of pulses;

c) each train of pulses corresponds to a recurring time window allocated to one of the channels; and

d) the respective wavelength associated with each of the channels is a wavelength of modulated radiation generated by said non-linear mixing.

13. (Amended) The method of claim [8] <u>12</u>, wherein the output radiation is generated by operating a voltage-tunable laser.

14. (Amended) The method of claim [8] <u>12</u>, wherein the pattern of wavelength variation defines respective, recurring time windows during which data content is to be allocated to corresponding wavelength channels.

20. (Amended) The method of claim 15, wherein[:further comprising]:

a) the method further comprises optically demultiplexing the received signal, thereby to provide two or more single-channel optical signals;

b) the method further comprises detecting each of the single-channel signals, thereby to provide two or more single-channel electronic signals; and

c) the assembling step comprises electronically multiplexing the single-channel electronic signals.

25. (Amended) The optical communication system of claim 22, wherein:

the data signal source is an electronic signal source;

the apportioning system comprises an electronic demultiplexer operative in response to the data signal to generate two or more distinct driver signals;

the apportioning system further comprises a respective optically emissive device operative in response to each driver signal to generate a corresponding optical signal in a distinct wavelength channel; and

the output element comprises an optical [demultiplexer] <u>multiplexer</u> operative to combine the respective optical signals and couple them into the transmission medium.